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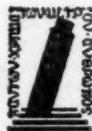
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AID FOR EMOTIONAL INSTABILITY

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THE MIRROR TRACING TEST AS A DIAGNOSTIC AID FOR EMOTIONAL INSTABILITY¹

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Tracing a star in mirror vision has, according to Whipple (1915), been in use in psychological laboratories for studies on learning and muscular movement for half a century. The use of this technique in studying the efficiency of motor performance as an indicator of personal stability was apparently first reported by Weidensall (1916). She found the average times in seconds taken on first trials (size of star not stated) to be: Bedford Reformatory inmates, 473.1; college maids, 133.6; and college students (women), 82.6. Error scores, i.e. quality of performance for the same groups were 204.6, 58.1, and 46.8 respectively. While the data are not presented as completely as one would like the author's confidence in the test is expressed thus: "this test isolates better than any we have tried at Bedford those who are incapable of sustained effort."

Holsopple (1932) divided male reformatory inmates by the quality of their star tracings into the poorest and best groups of 40 from a total population of 200 and compared certain items of their histories. Men in the poor performance group had had 105 arrests before conviction, while those in the good group had only 74; the poorest group had 52 reports for infractions of institution rules, while the best had only 37. Without presenting detailed evidence Holsopple claims definite value in this test for indicating instability and says, "those recidivists who seem to be rather the victims of an overwhelmingly unfavorable environment than to have deep-seated personal disabilities show a minimum of difficulties in their mirror drawing." Bois (1937), using a score combining time and errors found with 67 subjects that the distribution gave a J-shaped curve, with 62 subjects having scores between 50 and 500 points and 5 subjects scoring between 600 and 950 points. Each of these five subjects were found to be "particularly feeble in emotional control."

¹ Opinions expressed herein are those of the writer only and are not to be construed as official or reflecting the views of the Navy Department or the Naval service at large.

The essential agreement among these three studies, and the lack of contrary evidence would seem to justify further experimental exploration of the method.

METHOD

Apparatus. While the essentials of the mirror tracing apparatus are simple there has not been uniformity in the details among different investigators. Therefore, in the interests of standardization the apparatus used in this research is described. A mirror is mounted across one end of base board of 3 ply-wood, 16 x 12 1/5 inches. In front of this at about 7.5 inches is a frame of 1 x 0.75 inch wood to which are fastened angular blocks on either side to support a board screen. The frame is open at the base so that the records sheets can be fastened to the base board. These dimensions should be considered approximate, although they have been determined by experiment to be satisfactory.

The record blanks have a mimeographed six-pointed star with necessary blanks for identification and record. The star is inscribed in a circle with a 2.75 inch radius. It is placed on the sheet with one of the longest axes at an 18° angle from the vertical. In placing the sheet in the baseboard it is fastened with the lower edge even with the edge of the baseboard toward the subject. The starting point, which is toward the subject is marked with a short cross line and an arrow indicating the direction of initial movement.

Directions. With the sheet properly fastened the subject was allowed to place his pencil on the cross mark in direct vision. He was then told to look only in the mirror and the following directions were given: "Trace the outline of the star going in the direction of the arrow. Work as rapidly as you can but try to keep on the line. Keep your pencil on the paper all the time."

Scoring: Time. The time of performance was taken with a stop watch, from the first movement of the pencil until return to the cross line. Time was recorded only to the nearest quarter minute. The time for subjects who refused to complete the performance was taken at 20 minutes. In this experiment no time limit was imposed, but the data indicated that a limit of 10 or even 5 minutes may be suitable in practice.

Scoring: Quality. There is wide variation in the quality of performance with a continuous degree of gradation. Several methods

of measuring the quality of the performance were tried, none of which resulted in any differentials between the experimental and control groups. The simplest method of scoring quality was by rating the records on a five-point scale with the four groups roughly defined as follows (no partial credits given):

1. Good to excellent. All lines coincident with legs; not more than two small stops; not more than 3 lines off legs and these parallel to legs at not more than 1 millimeter distance; no cross lines; no corners cut.

2. Fair to good. Lines off not more than 3 millimeters but parallel to legs; more than two stops; lines not even or non-continuous; some, but not excessive, saw-tooth or looping lines.

3. Fair. Many cross lines; lines way off legs but fairly even and parallel; many stops; irregular loops.

4. Fair to poor. Majority of lines way off legs; excessive saw-tooth lines; excessive looping and stopping. In general very poor performance but evident attempt to follow the legs.

5. Poor and failure. Scribbling; failure to follow legs; short cuts so as to avoid at least two sides of one point; several lines drawn inside or outside of star perpendicular to legs; failure to complete within time limits; refusal to complete.

Combined scores. For a single score of performance the time scores in minutes have been weighted by multiplying by the quality scores. However, it will be evident that the time score alone is satisfactory.

Subjects. Data were secured from 86 problem men, the experimental group; and 82 normal men as a control group, making a total of 168. The experimental group included 58 patients at the psychiatric ward of the Naval Hospital, Washington, D. C. The diagnoses of these men were chiefly constitutional psychopathic state, psychoneuroses, and incipient dementia praecox, with several having no diagnoses but admitted for observation. The remaining 28 in this group were prisoners at the Indiana State Prison Farm, a minimal security institution with a high proportion of vagrants, drunkards, and similar types of problems.¹ As a group these men represented a cross section of the mild and borderline behavior problems indicative of unstable personality and adjustmental inadequacies. The control

¹ These data were secured through the courtesy of Mr. L. D. Cohen, Supervisor of Classification.

group was composed of 51 enlisted men and petty officers of the Hospital Corps on duty or under instruction at the Naval Medical School, 21 convalescent patients from the medical or surgical wards of the Naval Hospital and a miscellaneous group of 10 including medical officers and civilians.

RESULTS

Time scores. The essential raw data for the times on first trial are given in table 1. These data are given *in extenso* in order to show the essential similarity of the distributions for the sub-groups of experimental and control subjects. The average time taken by the experimental subjects was 5.38 minutes and for the controls only 2.68 minutes. The difference between these means has a C.R. of 5.0, which is slightly larger but of the same order as C.R.'s calculated on fewer cases at earlier stages of the investigation. While the size of this critical ratio indicates practical certainty that similar comparisons made on new groups of subjects would show a difference similar to

TABLE 1
DISTRIBUTION OF TIME SCORES

Time	Experimental				Control				
	N.P. Patients	Prisoners	Total	%	Corps Men	Patients	Misc.	Total	%
1	9		9	10.5	12	7		19	23.2
2	13	1	14	16.3	10	8	4	22	26.8
3	10	6	16	18.6	16	2	2	20	24.4
4	6	5	11	12.8	8	2	2	12	14.6
5	3	4	7	8.1	3	1	1	5	6.1
6	7	5	12	13.9	2	1	1	4	4.9
7	3	1	4	4.7					
8	1	1	2	2.3					
9	1	1	2						
10	0	0	0						
11-20	3	1	4	4.7					
DNC	2	3	5	5.8					
Totals	58	28	86		51	21	10	82	
Mean (minutes)		5.38				2.68			
standard dev.		4.86				1.39			
median		4.36				3.0			

this one, it is not of great usefulness in determining the clinical usefulness of the tool. For this purpose data on the proportions of the experimental groups which exceed certain score values of the control distribution are more significant. There were 81.3 percent of the experimental subjects who exceeded the median time of the control group; 33.8 percent of the experimental group exceeded 5 minutes in the time required, while only 4.0 percent of the control group did; finally 19.8 percent of the experimental group exceeded 6 minutes while none of the control groups required as much time.

Qualitative performance. The five classes of qualitative performance were empirically established by sorting all 168 records without distinction as to the group in which they fell. The lack of any statistically significant difference in the quality of performance between the experimental and control group is shown in table 2.

TABLE 2
DISTRIBUTION OF QUALITATIVE PERFORMANCE SCORES

Score	Control Group		Experimental Group	
	Number	Percent	Number	Percent
1	6	7.3	11	12.8
2	19	23.2	12	13.9
3	36	43.9	31	36.1
4	16	19.5	19	22.1
5	5	6.1	13	15.1

It is evident that the control subjects cluster about the mean somewhat more than do the experimental subjects. The differences in the percentages falling into the various quality classes for the two groups are not great: the difference in class 5 is greatest but this one is only 1.9 times its standard error. This finding of a lack of difference in quality of performance is further supported by an analysis of part of these data with a much more detailed scoring method. This was done with 68 control and 20 experimental subjects. The time and the qualitative performances showed no real differences.

Combined scores. In spite of the lack of significant difference between the quality score distributions for the two groups it is of some interest to analyze the combined scores. A coefficient of contingency of .078 between time and quality (using five steps for each measure) indicates a lack of relationship between these measures. This may be

taken to mean that time and accuracy are measures of quite different performances, and, therefore, time weighted by accuracy might give significant scores. The essential data, without the complete distribution, for the combined scores are given in table 3.

TABLE 3
STATISTICS FOR COMBINED SCORES

	Control	Experimental
Mean score	7.75	19.86
Standard deviation	5.45	23.35
Median	8.24	13.2
Percent exceed control median50	67.9
Percent exceed score of 20	2.4	25.5
Percent exceed score of 30	0	15.0

The critical ratio of the differences between the means is 4.9, indicating practical statistical certainty. The percentages of experimental subjects exceeding certain critical point are all slightly lower than the figures given for analogous points in the time scores.

DISCUSSION

The task presented by the star-tracing situation is that of adjusting to a reversal of the well established hand-eye coordination. It is evident from our own data and the other studies referred to that some subjects can do this readily while others require a long time, are very inaccurate, or even refuse to complete the task. There is no indication in these data that mental ability level is a significant factor in the performance. While not overtly evident in the records, observation of the subjects performing suggests that certain persons are calm and straightforward in their attack. Others are evidently emotionally disturbed, they are tense, make excessive movements, often concentrate at one point, may verbalize, and may even refuse to continue. As a working hypothesis we may say that subjects who show disturbance on the simple task presented by mirror-tracing will probably show disturbance when required to make other unfamiliar adjustments under pressure in non-laboratory situations. It was impossible to make detailed individual studies on all of our subjects, therefore we cannot attempt to test this hypothesis by individual comparisons of personality traits with performance. However, at least in a statis-

tical sense, the fact that a group of subjects selected because they had not been able to adjust in varying degrees had poorer performances than a group of adequately adjusted men would seem to support the hypothesis. Furthermore, the following average times for several diagnostic groups of the psychiatric ward patients are suggestive:

constitution psychopathic states	11 cases	4.7 minutes
psychoneuroses	15 "	5.7 "
dementia praecox	11 "	5.6 "
mental observation	6 "	3.1 "

The small number of cases involved in these sub-groups make the averages statistically meaningless, but it is of interest to note that these men who were in the hospital for observation only had lower time scores than those for whom a diagnosis had been made.

The data do not allow us to make definite statements concerning the meaning of scores in individual cases, with one exception. Since 20 percent of the experimental subjects took more than 6 minutes whereas none of the control subjects did, it seems reasonable to consider any subject requiring more than 6 minutes sufficiently unstable to warrant careful investigation. If to this critical time score we add a critical weighted score of 30 (above which 15 per cent of the experimental cases fell) we find that there are 23.2 percent of the experimental subjects included and none of the controls. Thus, it seems that high scores, time and weighted, on star tracing may be taken as indicating instability, but scores below the critical points cannot be taken to mean adequate stability.

SUMMARY AND CONCLUSION

1. 168 men traced a six-pointed star in mirror vision; 86 of these were behavior problems, and 82 were non-problem.
2. The average time score alone, and the average time weighted by quality scores were significantly greater for the problem than for the non-problem group.
3. The data showed critical points at 6 minutes and 30 points on the weighted scores. Above these points there were none in the control group, while there were 17.2 and 15 percent respectively in the experimental group. Selection using both criteria separated 23.2 percent of the experimental group.

4. It is suggested that subjects having scores higher than these critical points should be subject to careful examination for personal stability.

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